

STUDIES ON DIURETIC AND LAXATIVE ACTIVITY OF *ACACIA SUMA* (ROXB) BARKS

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ABSTRACT

The diuretic and laxative activity of aqueous extract of *Acacia suma* (Roxb.) barks (Family: Fabaceae) were studied in Wistar albino rats. Furosemide (10 mg/kg, p.o.) and agar-agar (300 mg/kg, p.o.) were used as reference standards respectively for activity comparison. The aqueous extract (400 mg/kg) has shown significant increase in the volume of urine, urinary concentration of Na⁺, K⁺ and Cl⁻ ions. However 200mg/kg dose failed to do so. On the other hand the extract was found to produce significant laxative activity in dose dependant manner. Presence of different phytoconstituents in aqueous extract of *Acacia suma* may be responsible for the specific activities.

KEYWORDS: *Acacia suma*, Acute toxicity study, Agar-agar, Diuretic activity, Furosemide, Laxative activity.

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INTRODUCTION

Acacia suma (Roxb.) var. *Acacia polyacantha* (Family- Fabaceae) is a medium sized erect tree; trunk with fissured bark and knobby persistent prickles found in the greater part of India and costal districts of Orissa^{1,2}. The bark is reported to be used as blood purifier² and possesses anti-cancer and astringent properties^{3,4}. The seeds are reported to have hypoglycaemic effect³. Presence of proanthocyanidin, quercetin and 5, 4'-dihydroxy-7, 3'-dimethoxyflavone-3-O-D galactopyranoside in the barks have been reported earlier³⁻⁵.

Present study aims at exploring the details of diuretic and laxative action of aqueous extract of *A. suma* barks.

MATERIALS AND METHODS

Plant material

The plant material was collected from the herbal garden of Regional Plant Research Centre, Bhubaneswar in July 2008 and identified by the taxonomists of the Botanical Survey of India, Shibpur, Howrah. A voucher specimen [Sp. No: CNH/ I-I / (17)/2009/Tech.II/28] has been kept in our research laboratory for further reference. After authentication, fresh bark material was collected in bulk, washed, shade dried and pulverized in a mechanical grinder to obtain coarse powder.

Preparation of the extract

The dried powdered material was macerated in distilled water: chloroform (9:1) to form an aqueous extract. The extract was concentrated to a small residue (5 gm) and the phytoconstituents in the extract were identified to be saponins, flavonoides, tannins, terpenoids and phenolic compounds by using standard methods^{6,7}. Furosemide (10 mg/kg, p.o.) and agar-agar (300 mg/kg, p.o.) were used as reference standards where applicable.

Animals

Swiss albino mice (20–25 g) of either sex were used for acute toxicity study and adult wistar albino rats (150-200 g) of either sex were used for evaluation of pharmacological studies. The animals were kept in standard polypropylene cages at room temperature of 34 ± 2 °C and at 60-65 % relative humidity during the experimental work. The institutional Animal ethics committee approved all the experimental protocols (Regd. No. 1212/ac/08/CPCSEA).

Acute toxicity study

The acute toxicity of aqueous extract of *A. suma* barks was determined as per the CPCSEA guideline no. 420 (fixed dose method). It was observed that the test extract was not mortal even at 2000 mg/kg dose hence, 1/10th (200 mg/kg) and 1/5th (400 mg/kg) of this dose was selected for further study.

Evaluation of Diuretic activity

The method of *Lipschitz et al.*, 1943 was employed for the assessment of diuretic activity^{8,9}. In this method, albino rats of either sex weighing 150 to 200 gm were divided into four groups of six animals each. The animals were fasted for 24 hrs and water was given *ad libitum* during fasting. On the day of experiment the animal groups were administered orally either with vehicle (1% Tween-80 in normal saline, 25 ml/kg) The first group of animals serving as control, received normal saline (25 ml/kg, p.o.), the second group received furosemide (10 mg/kg, p.o.) in saline¹⁰; Group-III and IV treated with aqueous extract (200 and 400 mg/kg) through oral route in a similar manner. Immediately after administration, the animals were placed in metabolic cages (2 per cage), specially designed to separate urine and faeces, kept at 20 ± 0.5 °C. The volume of urine collected was measured at the end of 5 h. During this period, no food and water was made available to animals. The parameters taken were the body weight before and after test period, total urine volume, concentration of Na⁺, K⁺ and Cl⁻ in the urine. Na⁺ and K⁺ concentrations were determined by flame photometer and Cl⁻ concentration was estimated by titration with silver nitrate solution (N/50) using 3 drops of 5% potassium chromate solution as indicator¹¹⁻¹³. The results are depicted in Table 1.

Evaluation of Laxative activity

The laxative activity was performed according to *Bose et al.* 2006¹⁴ on rats of either sex, fasted for 12 hours before the experiment, but with water provided *ad libitum*. The animals were divided into four groups, each group consisting of six rats. The first group of animals, serving as control, received normal saline (25 ml/kg, oral); second group, serving as reference, received agar-agar (300 mg/kg, p.o.) in saline; the third and fourth groups received orally the test extract at doses 200 and 400 mg/kg respectively in a similar manner. Immediately after dosing, the animals were separately placed in specially designed plastic containers suitable for collection of faeces. After 8 hours of drug administration, the faeces were collected and weighed. Thereafter, food and water were given to all rats and faecal outputs were again weighed after a period of 16 h (Table 2).

Statistical analysis

The data obtained in the studies were subjected to one way of analysis of variance (ANOVA) for determining the significant difference. The inter group significance was analyzed using *Dunnet's-t* test. A P-value < 0.05 were considered to be significant. All the values were expressed as mean \pm SEM.

RESULTS

Preliminary phytochemical tests revealed presence of saponins, flavonoides, tannins, and phenolic compounds in the aqueous extract of *A. suma* barks. The treatment with aqueous extract (400mg/kg) has significantly enhanced the volume of urine. However, the test extract at lower dose (200mg/kg) failed to do so. The urinary levels of Na⁺, K⁺ and Cl⁻ ions were significantly increased by 400mg/kg of test extract. The diuretic activity demonstrated by the test extract at 400 mg/kg was significantly lesser than the standard drug (Furosemide-10 mg/kg). The results are compiled in the **table 1**.

The aqueous extract of *A. suma* (200 and 400 mg/kg, oral) showed significant and dose dependant increase in faecal output of rats (**Table 2**) at selected dose levels. The effect was comparable with that of standard (Agar-agar).

DISCUSSION

Diuretics relieve pulmonary congestion and peripheral edema and are useful in reducing the syndrome of volume overload, including orthopnea and paroxysmal nocturnal dyspnoea. They decrease plasma volume and subsequently venous return to the heart (preload). This decreases cardiac workload, oxygen demand and plasma volume, thus decreasing blood pressure¹⁵. Thus, diuretics play an important role in hypertensive patients. In present study, we can demonstrate that the aqueous extract of *A. suma* barks significantly increased the urinary out put as well as urinary electrolyte concentration at a dose of 400 mg/kg, p.o. but the effect was found to be the less potent in increasing the urinary out put when compared with the reference standard. Further, the aqueous extracts were found to be more effective in enhancing urinary electrolyte concentration for all the three ions tested (Na⁺, K⁺, Cl⁻). The increase in the ratio of concentration of excreted sodium and potassium ions indicates that the extracts increase sodium ion excretion to a greater extent than potassium, which is a very essential requirement of an ideal diuretic with lesser hyperkalaemic side effect.

The laxative activity study revealed significant activity of the aqueous extracts up to 8 h of drug administration. The aqueous extract was found to be superior to that of the standard drug. Presence of phytoconstituents like flavonoids, terpenoids, saponins, have been previously found to be responsible for diuretic and laxative activities in plants^{16,17}. The presence of the said constituents in aqueous extract of *A. suma* barks may be responsible for the observed diuretic and laxative activities. The exact mechanism exhibited by the extracts can only be established after further investigation.

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Table 1: Diuretic activity of aqueous extract of *A. Suma* barks

Group	Treatment	Dose	Urine Volume (ml)	Concentration of ions (mEq / l)			Na ⁺ / K ⁺ ratio
				Na ⁺	K ⁺	Cl ⁻	
I	Control	25 ml/kg	2.14 ± 0.15	52.33 ± 2.15	139.5±0.42	106.22±3.46	0.38
II	Furosemide	10mg/kg	7.16 ± 0.37**	96.33± 3.71**	163.67 ± 8.84**	136.96± 4.29**	0.59
III	Aqueous extract	200 mg/kg	2.29±0.12	51.43±3.16	140.72±2.68	100.88±4.77	0.37
IV	Aqueous extract	400 mg/kg	5.06±0.15**	68.11±1.47**	155.10±1.53*	120.36±3.68**	0.44

Values are expressed as mean ± S.E. (n = 6). All columns are significant using ANOVA. * P<0.05, **P<0.01 when compared to control; Dunnet's t-test.

Table 2: Laxative activity of aqueous extract of *A. Suma* barks

Group	Treatment	Dose	Faecal Output (g)	
			8h	8-16h
I	Control	25 ml/kg	0.886±0.487	0.622±0.860
II	Agar-agar	300 mg/kg	1.166±0.477**	0.638±0.765
III	Aqueous extract	200 mg/kg	1.209±0.672**	0.598±0.600
IV	Aqueous extract	400 mg/kg	1.216±0.761**	0.610±0.517

Values are expressed as mean ± S.E.M (n = 6). All columns are significant using ANOVA. *P<0.05, ** P<0.01 when compared to control; Dunnet's t-test.

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